

REMARKS

Applicants have amended their claims in order to further clarify the definition of various aspects of the present invention. Specifically, Applicants have amended claim 11 by incorporating therein the subject matter of claim 14, and to recite the aspect ratio of “a” micro pillar of said micro pillar group, noting that previously considered claim 11 recited a group of micro pillars. In light of amendments to claim 11, claim 14 has been cancelled without prejudice or disclaimer. In addition, in order to facilitate proceedings in connection with the above-identified application, claims 2-8 and 19-26 have been cancelled without prejudice or disclaimer.

Thus, the claims remaining in the application that have previously been considered on the merits are claims 11-13 and 28-31.

In addition, claim 16 has been amended to recite a method for manufacturing a micro biochip, consistent with its parent claim 13.

The concurrently filed RCE Transmittal is noted. In view of the filing of this RCE Transmittal, entry of the present amendments is clearly proper, notwithstanding Finality of the Office Action mailed October 29, 2007.

In addition, it is respectfully submitted that the present amendments clearly constitute the necessary submission under 37 CFR 1.114, supporting the RCE Transmittal.

The objection to claims 21 and 22 under 37 CFR 1.75(c), set forth in the last paragraph on page 2, and the first paragraph on page 3, of the Office Action mailed October 29, 2007, is moot, in light of present cancelling of claims 21 and 22.

Moreover, the rejection of claim 19 under the second paragraph of 35 USC 112, set forth on page 3 of the Office Action mailed October 29, 2007, is moot, in light of present cancelling of claim 19.

Applicants respectfully submit that the claims being considered on the merits in the above-identified application patentably distinguish over the teachings of the prior art applied by the Examiner in rejecting claims in the Office Action mailed October 29, 2007, that is, the teachings of U.S. Patent No. 7,195,872 to Agrawal, et al., under the provisions of 35 USC 102 and 35 USC 103.

It is respectfully submitted that the reference as applied by the Examiner would have neither taught nor would have suggested such a micro biochip as in the present claims, including, inter alia, wherein an aspect ratio of a micro pillar of the micro pillar group of the micro biochip is 4 or more, and wherein a plurality of micro pillar groups of organic polymer are provided in a flow path for feeding a sample, and the tip end of the micro pillar is kept in contact with an upper substrate constituting the flow path. Note claim 11.

See, e.g., the paragraph bridging pages 31 and 32, and the paragraph bridging pages 32 and 33, of Applicants' specification. Note also the first full paragraph on page 33 of Applicants' specification, describing that by utilizing the upper substrate 1001 (see Fig. 8 of Applicants' disclosure) and allowing the substrate to come in close contact with the micro pillar group 1000, this configuration prevents the sample from leaking through the gap between the micro pillar group 1000 and upper substrate 1001, thereby ensuring a highly sensitive analysis.

In addition, it is respectfully submitted that the teachings of the applied reference would have neither disclosed nor would have suggested such a micro biochip as in the present claims, having features as discussed previously in connection with claim 11, and further including, inter alia, features as in claims dependent on claim 11, such as (but not limited to) wherein the organic polymer is modified on the surface of the micro pillars (see claim 12); and/or wherein the

organic polymer contains at least one of antigen, sugar chain and bases (see claim 13); and/or wherein the micro pillar group is a group of micro pillars formed by pressing a mold, having pits, against the material such that the material is pressed into the pits, and separating the mold therefrom, thereby to elongate the columnar micro pillars from the matrix surface (see claim 28), particularly wherein the organic polymer is modified on the surface of the micro pillars (see claim 29); and/or wherein the material of the group of micro pillars includes such an organic polymer that elongates when the mold, having the material of the group of micro pillars therein, is separated therefrom (see claims 30 and 31).

The invention being considered on the merits in the above-identified application is directed to a micro biochip, being equipped with micro pillar groups.

As described on pages 1-3 of Applicants' specification, various types of nano-pillar structure have been proposed, formed by various techniques. For example, a nano-silicon pillar group using a metallic cluster such as iron, gold and silver as a self-forming nucleus of a plasma etching mask has been proposed. Another technique forms resin-made micro pillars, in which the surface of a silicon substrate is coated with a polymethyl methacrylate film; a mask of a silicon substrate is placed on the film through a spacer; and then heating is performed, in order to form micro pillars on the polymethyl methacrylate film.

However, previously proposed structures involved certain problems. For example, formation of the nano-pillars as described in the foregoing is restricted to inorganic materials, and requires a dry etching method. Moreover, in forming the polymethyl methacrylate micro pillars, it has been difficult to control the position, the diameter and height of the micro pillars freely.

Against this background, Applicants provide structure that can easily and

effectively be provided, and which can provide accurate and precise micro pillars made of plastic material and incorporates such micro pillars in a micro biochip to ensure highly sensitive analysis using such micro biochip. Applicants have found that by forming the pillars of thermoplastic polymer material, the pillars having specified dimensions including an aspect ratio of at least 4, the micro pillars being provided in a flow path (for feeding a sample), the tip end of the micro pillar being kept in contact with an upper substrate constituting the flow path, objectives of the present invention are achieved. That is, the sample is prevented from leaking through a gap between the micro pillar group 1000 and upper substrate 1001, ensuring highly sensitive analysis. See page 33, lines 7-16, of Applicants' specification. Moreover, the micro pillars can be formed with high aspect ratio and high precision, and can be made of thermoplastic polymer material, thus forming a structure which is relatively inexpensive and which can be formed by an easy and relatively inexpensive method.

Agrawal, et al. discloses a substrate having a high surface area for use as a microarray device, wherein structural micro features are formed on a surface of a substrate that increases surface area and accessibility thereto. The described substrate includes a plurality of adjacent microfeatures on a surface of a substrate arranged in spatially discreet regions to provide a texture on the surface, the textured surface providing an increase in surface area as compared to a non-textured surface. This patent discloses the substrate may include a material selected from the group consisting of glass, a ceramic, a metal, a non-metal and a polymer; and that the microfeatures may include a material that is different from the material of the substrate, this material being selected from a group consisting of glass, a ceramic, a metal, a non-metal, an inorganic oxide and a polymer. This patent discloses that a

plurality of microfeatures may include a pit, a trench, a pillar, a cone, a wall, a micro-rod, a tube, a channel or a combination thereof. Note column 4, lines 41-58. See also column 4, lines 63-67, describing aspect ratios of the microfeatures, among other aspects thereof. In column 5, lines 12-18, this patent discloses that the surface further includes a plurality of microstructures, which may comprise a pit, a trench, a pillar, a cone, a wall, a micro-rod, a tube, a channel or a combination thereof. As to what is meant by "microfeatures" and "microstructures", note column 11, lines 19-36 of Agrawal, et al. See also column 6, lines 46-54; and from column 6, line 60 through column 7, line 3. See also column 15, lines 12-18 and 53-57; and column 16, lines 56-60. Note, further, column 17, lines 7-14, 24, 25 and 43-46.

Attention is respectfully directed to Example 13 in column 54 of Agrawal, et al., and Fig. 9 in connection therewith. That is, Fig. 9 illustrates a reaction vessel that comprises contacting textured surfaces of the substrates, two substrates 901, 902 being placed such that the textured surface of substrate 901 is facing the textured surface of substrate 902. This patent further discloses that a well of substrate 901 is placed directly opposite the micro feature of substrate 902; and that in embodiments that involve hybridization, hybridization fluid is placed in the space between the two substrates, and during hybridization one of the two substrates is laterally oscillated, thereby creating a turbulent flow which promotes efficient mixing and, thus, a high degree of hybridization and a reduction in hybridization time. Note particularly column 54, lines 17-31, of Agrawal, et al., together with Fig. 9 thereof.

As seen especially in Fig. 9 of Agrawal, et al., this patent would have neither disclosed nor would have suggested such structure as in the present claims, including wherein the tip end of the micro pillar is kept in contact with an upper substrate constituting the flow path, much less the plurality of micro pillar groups of

organic polymer being provided in the flow path, especially together with dimensions of the micro pillars, including aspect ratio thereof, and advantages thereof as discussed previously.

In the last two lines of the paragraph bridging pages 3 and 4 of the Office Action mailed October 29, 2007, in discussing the teachings of Agrawal, et al., the Examiner refers to the two substrates 901, 902 being stacked, comprised of layers of microfeatures, the Examiner referring to Fig. 9 of Agrawal, et al. However, it must be emphasized that claim 14 as previously considered, and claim 11 as now amended, recites that the tip end of the micro pillar is kept in contact with an upper substrate constituting the flow path. It is respectfully submitted that such structure as in claim 11 would have neither been taught nor would have been suggested by the disclosure of Agrawal, et al., even as shown in Fig. 9 wherein tip ends of the micro pillars do not contact, e.g., micro pillars of the opposing substrate.

In addition, it is emphasized that Agrawal, et al., in the embodiment of Fig. 9, provides the substrates 901, 902 to promote turbulent flow which promotes efficient mixing. It is respectfully submitted that such disclosure as in Agrawal, et al. does not teach, nor would have suggested, the plurality of micro pillar groups being provided in a flow path, much less that the tip end of the micro pillar is kept in contact with an upper substrate constituting the flow path, and advantages thereof as in the present invention.

Applicants respectfully traverse the contention by the Examiner in connection with previously considered claim 14, that this claim "recites the act of providing the claimed invention in a flow path". To the contrary, it is respectfully submitted that the flow path is a positive recitation in the present claims, with respect to location of the plurality of micro pillar groups. Noting that the present claims recite a flow path "for

feeding a sample", it must be recognized that the flow path itself forms part of the structure, and is not part of the intended use. Properly construing the claims, it is respectfully submitted that the teachings of Agrawal, et al. does not disclose, nor would have suggested, such micro biochip as in the present claims, having features thereof as discussed previously including the location of the plurality of micro pillar groups of organic polymer in a flow path, much less that the tip end of the micro pillar is kept in contact with an upper substrate constituting the flow path.

It is emphasized that according to the present invention, by providing the tip end of the micro pillar in contact with an upper surface constituting the flow path, the sample is prevented from leaking through the gap between the micro pillar group 1000 and upper substrate 1001, thereby ensuring highly sensitive analysis. In contrast, Agrawal, et al. discloses the structure of the embodiment in Fig. 9 using two substrates, to increase throughput and eliminate the need for a cover slide. See column 54, lines 30 and 31, of Agrawal, et al. It is respectfully submitted that Agrawal, et al. would have neither disclosed nor would have suggested the structure of the micro biochip of the present claims, and advantages thereof.

The Examiner's attention is also directed to claim 16, reciting a method for manufacturing a micro biochip according to claim 13. Claim 16 has been withdrawn from consideration, as being directed to a non-elected invention. It is respectfully submitted that upon allowance of claim 13, directed to the micro biochip, claim 16 should be re-joined in the above-identified application and allowed to issue in a U.S. patent issuing therefrom, since if the micro biochip is patentable then the claimed method of production thereof in claim 16 would also be patentable.

If any issues remain as an obstacle to allowance of the present claims, the Examiner is respectfully requested to contact the undersigned, at the convenience of

the Examiner, to schedule an interview so as to overcome any such remaining issues. The Examiner is thanked in advance for cooperating with this request.

In view of the foregoing comments and amendments, and in view of the concurrently filed RCE Transmittal, entry of the present amendments, and reconsideration and allowance of all claims presently being considered on the merits in the above-identified application, as well as claim 16, are respectfully requested.

To the extent necessary, Applicants hereby petition for an extension of time under 37 CFR 1.136. Kindly charge any shortage of fees due in connection with the filing of this paper, including any extension of time fees, to the Deposit Account of Antonelli, Terry, Stout & Kraus, LLP, Account No. 01-2135 (No. 520.43241X00), and please credit any overpayments to such Deposit Account.

Respectfully submitted,

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